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FORTRAN IV Program Calculates Velocities and Streamlines in a Tandem Blade Turbomachine

The problem:

Efforts are being made to design compressors and turbines with smaller diameters, fewer stages, and fewer blades per stage. All these factors tend to increase diffusion. Therefore, it is desired to design blades with high diffusion, and at the same time avoid flow separation. Two concepts for accomplishing this are the tandem blade and the slotted blade. However, it is necessary to have a method of calculating the velocity distribution on the surface of such blades; this computer program provides an easy method.

The solution:

A computer program which gives the blade-to-blade solution of the two-dimensional, subsonic, compressible (or incompressible), nonviscous flow problem for a circular or straight infinite cascade of tandem or slotted turbomachine blades. The blades may be fixed or rotating. The flow may be axial, radial, or mixed.

How it's done:

The method of solution is based on the stream function using an iterative solution of nonlinear finite-difference equations. These equations are solved using two major levels of iteration. The inner iteration consists of the solution of simultaneous linear equations by successive overrelaxation, using an estimated optimum

overrelaxation factor. The outer iteration then changes the coefficients of the simultaneous equations to correct for compressibility.

The program input consists of the basic blade geometry, the meridional stream channel coordinates, fluid stagnation conditions, weight flow and flow split through the slot, and inlet and outlet flow angles. The output includes blade surface velocities, velocity magnitude and direction throughout the passage, and the streamline coordinates.

Notes:

1. This program should be of interest to engineers and designers of compressors and turbines.
2. The program is written in FORTRAN IV for use on the IBM 7094 11/7044 DCS.
3. Inquiries should be made to:

COSMIC
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Reference: B69-10219

Patent status:

No patent action is contemplated by NASA.
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